WWF

READING PUGMARKS

A pocket guide for forest guards

Revised edition by
Ranjit Talwar
Amir Usmani

Tiger & Wildlife Programme

2005

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Contents

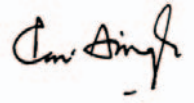
Preface

In keeping with requests from the field, WWF India is bringing out this small publication on reading pugmarks of tigers and leopards. The publication is the second handbook published by WWF- India to address the needs of the 'foot- soldier' of our forests… the forest guard. The first by Dr L.A.K. Singh was published in 1999. This illustrated publication produced in an easy to use manner is only meant to serve as a rough guide for collecting data from the field, whether for daily monitoring of the movement of large cats or for the periodic enumeration of their populations by the forest department.

As technology evolves into the digital sphere and science progresses for the betterment of conservation, it is necessary that some of our older methods of collecting and analyzing pugmarks are not forgotten. Whilst this is not to debate the best final method within present science, the work of our past foresters and naturalists must be acknowledged. Of the many who have

contributed to our knowledge, I would mention the work of Wynter Blyth and DharmakumarSinhji on the census methodology of the Asiatic lion.

This comes with the best wishes of WWF India in the trust that the contents be used constructively and well.



New Delhi — Ravi Singh

July 2005 — Secretary General & CEO

WWF - India

Foreword

Reading pugmarks was an art that had once been perfected by professional trackers known as *shikaris* during the heydays of tiger hunting in colonial India. Such *shikaris* were maintained on the payrolls of the Indian Royalty and the British colonial rulers and had the sole responsibility of providing their near magical skills during *shikar*. Some of the master trackers were reputed to possess phenomenal capabilities and could follow the trail of tigers and other animals over ground that hardly registered the movement of any animal. A bent twig or an upturned pebble was enough for them to follow a trail. They could determine the sex, age and size of a tiger from its pugmark as well as identify individual animals with a great deal of accuracy and ease. It is this last mentioned skill that we will endeavour to focus upon in this booklet for the purpose of enumerating tiger populations.

Unfortunately, the skills of trackers were never documented and were practised only as an art and not as a science. The knowledge was either acquired through practical experience in the field or was passed down from father to son. In 1934 a forest officer, J.W. Nicholson, of the Imperial Forest Service

utilized one small aspect of the tracker's knowledge for counting tigers in the Palamau Forest Division. This was the first attempt to convert the art of identifying individual tigers into a science.

With the departure of the British and the collapsing privileges of the Indian princes, the trackers went into oblivion and their art was nearly lost. In the 1960s, an eminent forest officer of Orissa, Saroj Raj Choudhury, revived the work of Nicholson related to identifying individual tigers from their pug impressions and developed it into a technique for application in the field.

Subsequently, L.A.K. Singh, and still later, members of WWF- India staff have all played a significant roles in bringing about major improvements to present the old art form in a manner that can be understood and uniformly applied by the 'foot- soldiers' of our forests — the Forest Guards. **However, this booklet is limited to the collection of data from the field and does not deal with the analysis of such data to arrive at population estimations. The contents of this booklet may be used with the permission of the State forest authorities.**

The pugmark method of estimating tiger populations is a cost effective, practical and easy to apply method that is capable of producing fairly accurate results, provided the persons using it are adequately trained. Criticism of this method in the past has been most unfair to this time-tested methodology. If the persons using this technique are inadequately trained, this method, like most other techniques will produce faulty results. However, notwithstanding the criticism, this still remains the most widely used technique for enumerating tiger populations in the field.



New Delhi
July 2005

PK Sen
Director
Tiger and Wildlife Programme

Why are pugmarks important?

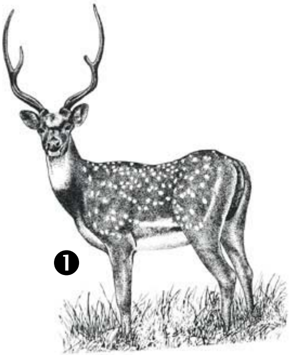
- Pugmarks are recorded whenever an animal moves through the jungle over suitable ground.
- Pugmarks are easy to find indirect evidence of an animals presence.
- With some basic training and an honest approach, the information contained in the pugmarks can be easily recorded through traces and plaster casts for analysis at a higher level.
- If analysed skillfully and honestly, pugmarks can provide reliable data of:
  - Presence of different species in the area of study.
  - Population of large cats.
  - Sex ratio of large cats.
  - Identification of individual animals. The greater the skill, the greater the accuracy. **This forms the basis for estimating tiger and leopard populations**.

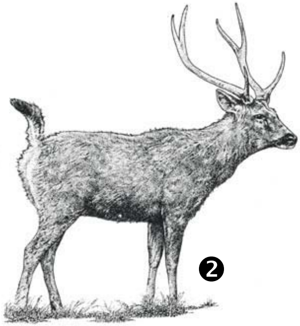
Changes in numbers and composition of large cats indicate the trend of success or of failure of their conservation efforts.

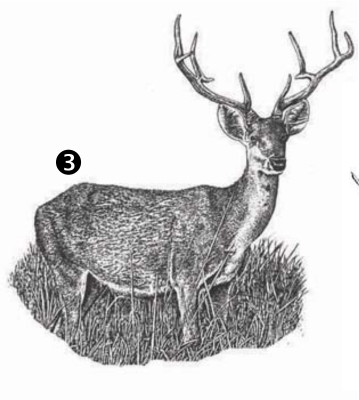
Commonly met animals in a tiger habitat

Members of the deer and antelope family:

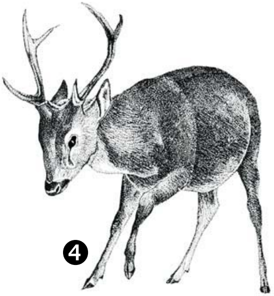
1. Cheetal
2. Sambar
3. Barasingha
4. Hog deer
5. Barking deer
6. Chausingha
7. Neelgai



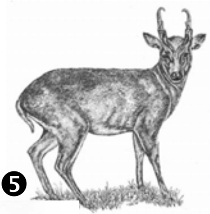




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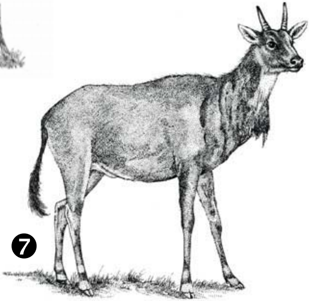
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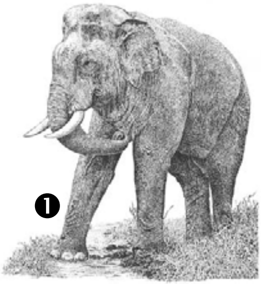


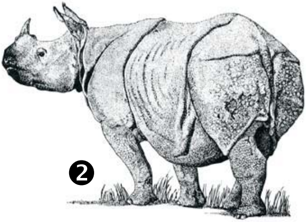
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Commonly met animals in a tiger habitat

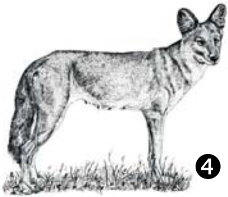
Other major species:

1. Elephant	2. Rhino	3. Wild pig
4. Wild dog	5. Wolf	6. Hyaena
7. Jackal	8. Indian Fox	9. Ratel
10. Sloth Bear	11. Porcupine	12. Gaur



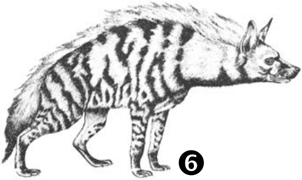




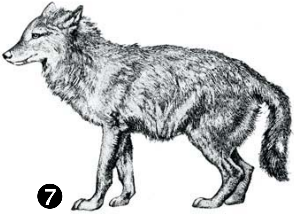




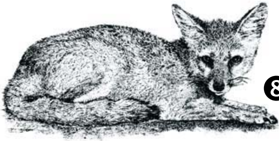
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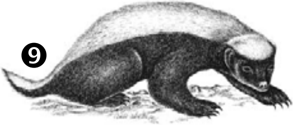
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Commonly met animals in a tiger habitat

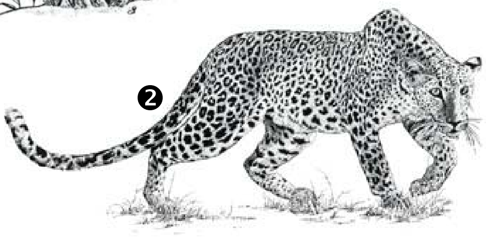
Cats:

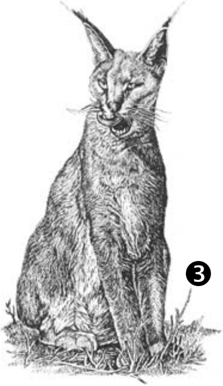
1. Tiger
2. Leopard/Panther
3. Caracal
4. Leopard cat
5. Jungle cat
6. Fishing cat

❶

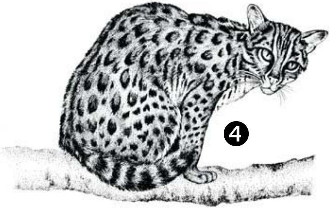


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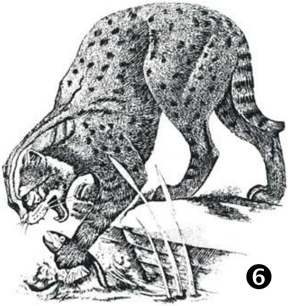
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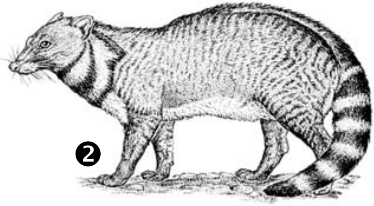
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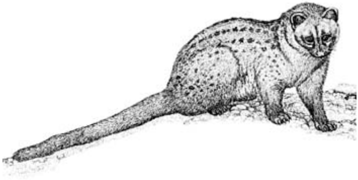
Commonly met animals in a tiger habitat

Civets:

1. Small Indian Civet 2. Large Indian Civet 3. Palm Civet





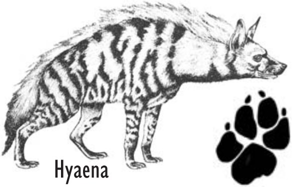


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Commonly seen foot-prints of soft-padded animals other than cats



Wolf



Hyaena



Ratel



Sloth Bear



Front



Hind



Wild Dog

Broad differences between pugmarks of members of the cat and dog families

Since most of the soft-padded four-toed pugmarks seen in the jungle belong to either the cat or the dog family, it is important to understand their distinctive features.



Pugmark of a Dog



Pugmark of a Cat

Note:

1. While claw marks are visible in a dog's pugmark, in cats, unless they are walking over slippery or very steep ground, or are startled, claw marks are not visible.
2. In the dog family, except in the case of hyaena, the gap

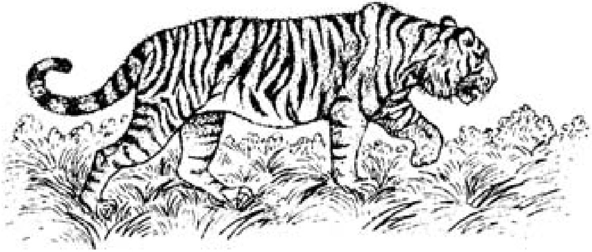
between the top of the pad and the two middle toes is distinctly more than what is found in cats.

3. Carefully compare the ratio of toe to pad size in both cases. Toes comparatively larger in dogs. Pad comparatively larger in cats.

Animals that run down their prey in a dog like manner have large toes when compared to their pad size.

Animals that catch their prey by stealth, such as in cats, have large pads when compared to their toe size.

Placement of limbs



Tiger walk, showing all four limbs



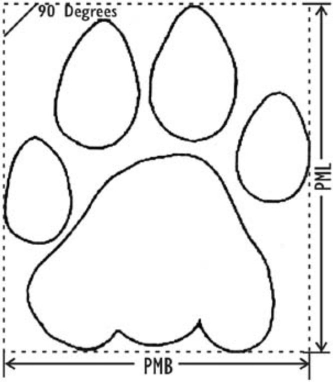
Placement of paw on ground

Design of a tiger's paw



1. A tiger's paw consists of a pad and four toes.
2. A fifth toe commonly called the dew claw, is placed high on the front limbs only.
3. Dew claws are retractable and are a part of the tiger's weaponry.
4. Ordinarily, the dew claw does not touch the ground.
5. The pad is 3-lobed at the rear end.

Measuring a pugmark

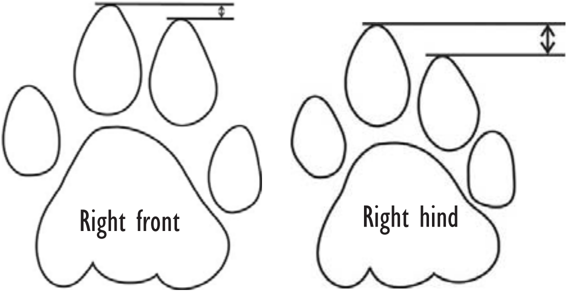


Pugmark Length or PML is the measurement from the tip of the farthest toe to the base of the pad along the line of walk.

Pugmark Breadth or PMB is the measurement between the outer edges of the first and last toe.

The above are measured by drawing a box (all corners at 90 degrees) touching the extreme ends of the pugmark.

Distinguishing the hind from the front pugmark



1. Front pugs are larger than hind pugs.
2. In a front pug, the forwardmost points of the two middle toes are almost at the same level.
3. In hind paws, the forwardmost points of the two middle toes are distinctly at different levels.
4. In male tigers, the PMB of the front pug is mostly greater than its PML.
5. Since front pugs are used for killing prey, injuries if any, are sustained on front paws. Wherever existing, these may be visible on front pugmarks and may serve as a conclusive identification feature of a specific animal.
6. Man caused injuries could be sustained on any of the pugs.

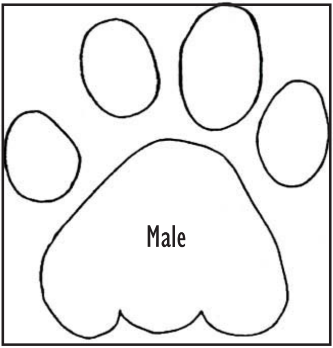
Distinguishing the right and the left pugmark

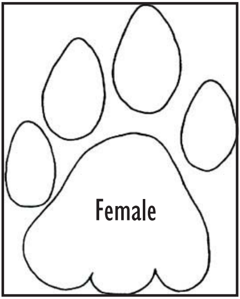


1. Fold-in the thumbs of both your hands.
2. Stretch out the remaining four fingers in each hand.
3. In your left hand you will see that the third finger from the left is the longest. This occurs in the tiger too.
4. In your right hand you will see that the third finger from the right is the longest. This occurs in the tiger too.

For population estimation, always select the hind left pugmark for tracing and plaster casts, for uniformity, unless right hind is specified by the CWLW for the entire state. Select front pugmark only if the front pugmark stands out distinctly due to an injury or deformity. Even in such cases, the hind left pugmark must also be traced and submitted attached to the tracing of the deformed pugmark.

Distinguishing the hind pugmark of male and female





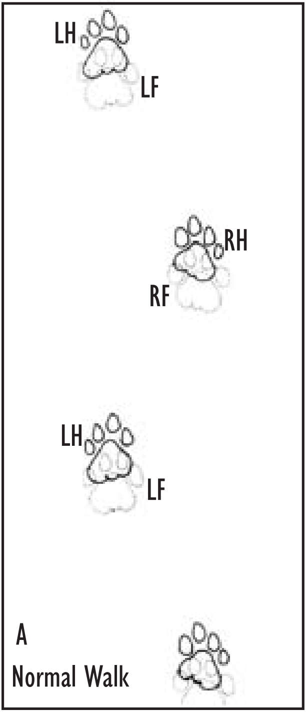
Note:

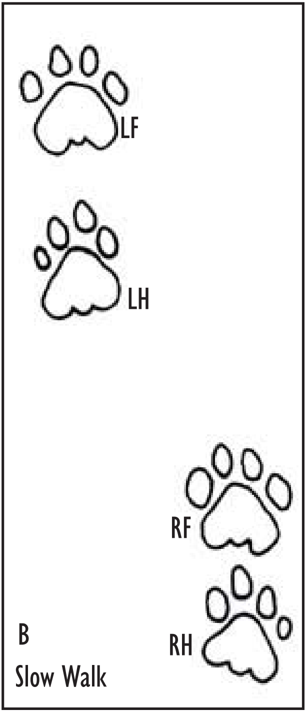
1. The pugmark of a male almost fits into a square.
2. The pugmark of a female fits into a rectangle.
3. The shape of toes in a male is more rounded.
4. The shape of toes in a female is elongated.
5. If the difference between PML and PMB is less than 1.5 cms, the pugmark is likely to be that of a male.
6. If the difference between PML and PMB is more than 1.5 cms, the pugmark is likely to be that of a female.

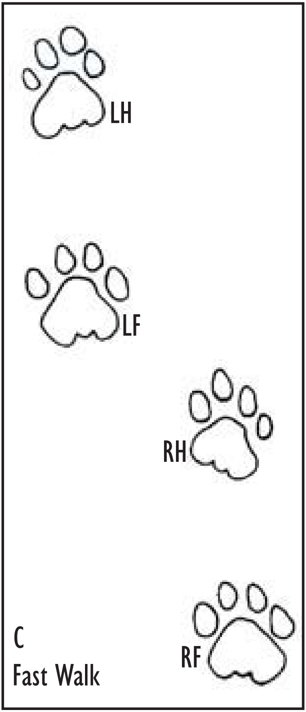
The above distinctions, including the shape of toes are not applicable to the front pugmarks.

The walk sequence

The placement of pugs varies with the speed of a tiger's walk.





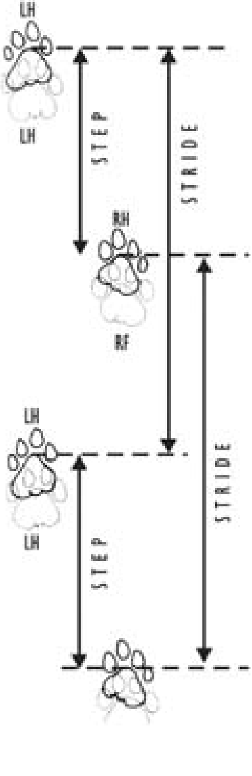


Note:

A. In this the hind pugmark falls over the front. pugmark; fully or partially.
B. Hind pugmark falls behind the front in a slow walk.
C. Hind pugmark falls ahead of the front during fast or hurried movement.

For data collectiom we need to select a walk sequence where the tiger has moved at normal speed. Select the best left hind pugmark for tracing on Form-D, and for plaster casting.

Other important measurements



Importance of stride measurement

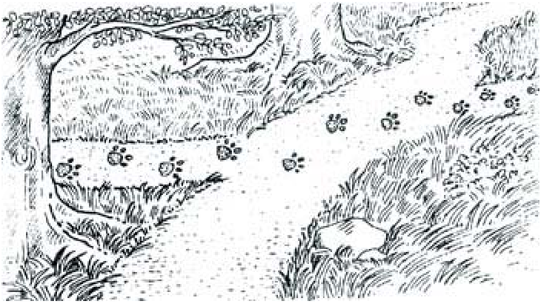
- Stride measurements help in distinguishing between tigers with similar size pugmarks.
- The length of stride helps in distinguishing pugmarks made by tiger cubs from those made by adult leopards.

How to measure?

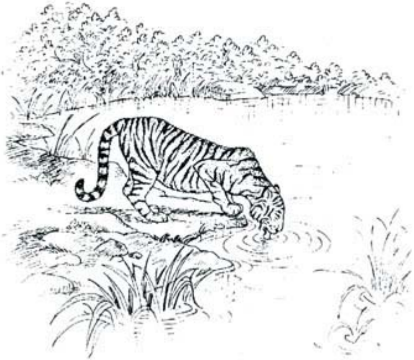
- Select a walk sequence where the tiger has moved at normal speed.
- Select two consecutive hind pugmarks for measurements.
- Measure the distance between the hind left to the next hind left or hind right to the next hind right.
- Hold zero-end of measuring tape at the front tip of the pad of the first pugmark. Stretch the tape to the tip of the pad of the second pugmark.
- Record distance in cms.
- Distance between left and right pugmark gives the length of the step.

> Remember that a stride is equal to twice the length of a step.

Where to search for tiger pugmarks



Dusty forest roads, tracks and animal trails



Near water-holes

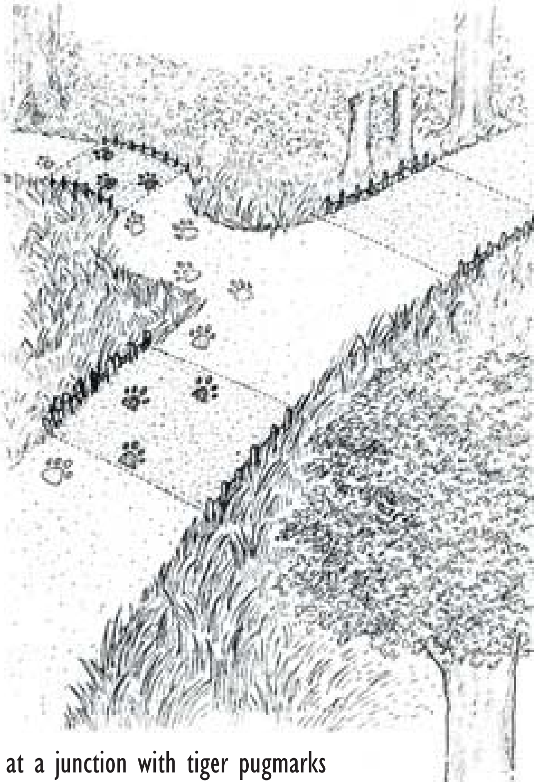
Where to search for tiger pugmarks

Search along:

1. Dusty or damp ground.
2. Forest paths and roads.
3. Animal trails.
4. River and stream beds.
5. Near water holes.
6. Dry nala beds.
7. In the vicinity of natural salt licks.

Normally, tigers and leopards avoid going through bushes with thorns or those laden with water or dew. These are cats, after all!

Techniques for obtaining good pug impressions



PIPs at a junction with tiger pugmarks

As soil conditions dictate the quality of pugmarks formed, the ideal would be to lift pugmarks made in similar soil conditions. This is never possible under natural circumstances as the soil conditions vary substantially in different parts of the same forest. This problem is overcome through the creation of man-made Pug Impression Pads (PIPs).

Equating the variable soil conditions

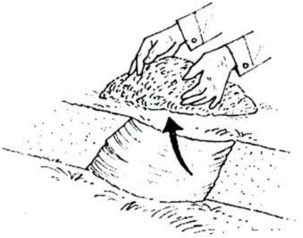
- PIPs are Pug Impression Pads.
- PIPs are laid along routes where tiger and leopard are likely to move or where they are known to frequent.
- PIP is a patch of dusty earth created manually for getting good pug impressions.
- A PIP is 2m long along the length of the track and covers the entire width.
- A PIP is large enough to allow the registration of 3 to 4 pugmarks.
- A PIP site should be so selected to ensure that the animal finds it difficult to bypass or avoid walking over it.
- PIPs should be made well in advance of the enumeration process. Animals are sometimes weary of stepping on newly prepared PIPs.
- The soil used for making the PIP should preferably be from the same surrounding area.

Prepare fine dust for good PIP. A good PIP will produce good pugmarks.

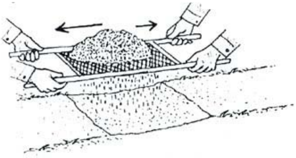
Laying of a PIP



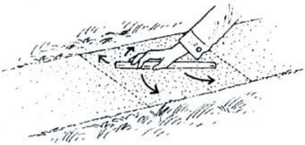
1. Dig upto 10cm of the path / track to make a strip 2m long x total width.



2. Collect the earth at one place.



3. Use a wire-mesh to sift a layer of fine dust on the marked strip.



4. Level the dust after the strip is filled and place natural obstructions on the sides to discourage bypassing of the PIP.

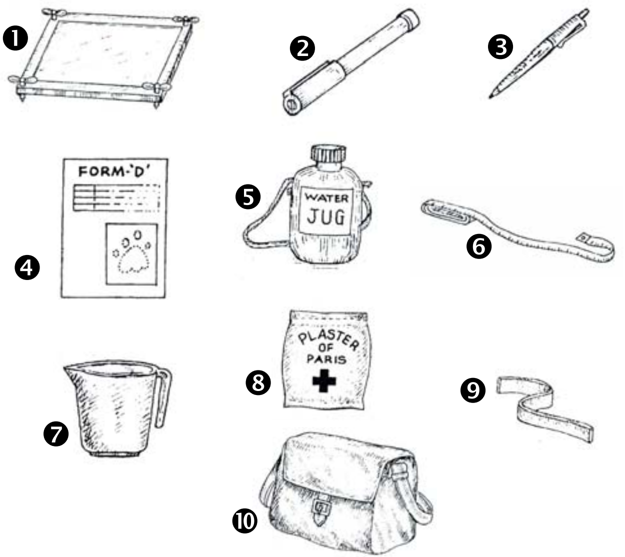
Upkeep of PIPs

- Must be created in advance.
- Pugmarks are likely to be disturbed by many factors such as the movement of vehicles during counting operations.
- Vehicle drivers should be asked to avoid main tracks near PIPs.
- PIP inspections must be completed by 10 a.m.
- After that, if necessary, vehicles may ply these routes upto 3 p.m.
- After every check, the PIP must be wiped clean.
- All debris like leaf litter, sticks etc. must be removed and PIPs got ready to receive fresh pugmarks.

> A good and well maintained PIP will produce good pugmarks. Good pugmark - Accurate count.

Contents of enumeration kit

1. Tiger tracer
2. Sketch pen
3. Ball pen
4. 2m long measuring tape
5. Form-D
6. Water bottle (2 litres)
7. Mug (500ml)
8. Plaster of Paris (Medical grade)
9. Flexible aluminium strips
10. Census bag

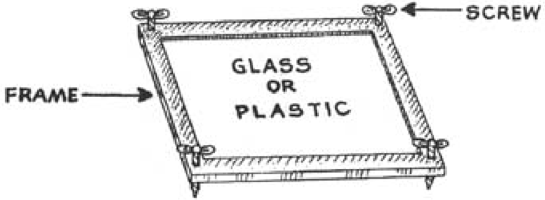


Data necessary for analysis

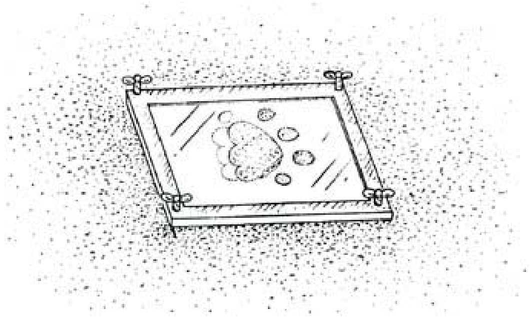
The data required for enumeration of tiger populations is recorded on Form 'D' (See page 46) with the help of a tiger tracer and by preparing a plaster cast.

A simple 'tiger tracer'

Size: 25cms X 20cm glass or plastic with 2cm broad wooden frame. For height adjustment, corner screws can be provided. Flat pebbles or sticks can also be used.

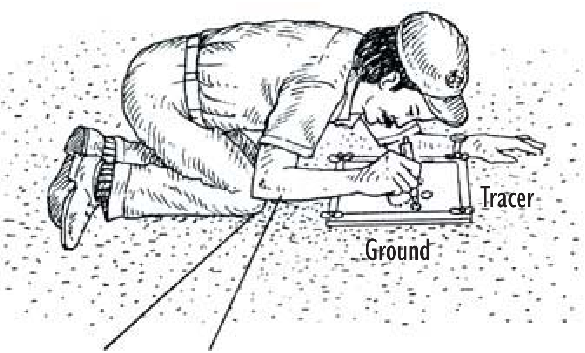


How to place the trace on pugmark



The correct position to trace pugmark on 'tiger tracer'

- Keep the 'tracer' as close to the pugmark as possible.
- 'Tracer' should be parallel to the pugmark.
- Kneel down near the pugmark.
- Keep your eyes directly above the pugmark.
- Rest elbows on the ground.
- Hold the sketch pen so as to allow free movement.
- Trace the outline of the pad and all four toes on to the glass surface of tracer.



Where to draw the line

1. The outline of the pad with three lobes at the rear and all four toes in the front, is to be drawn from the outline impression.
2. When the pugmark is less deep, the outline of pad and toes is easy to identify and trace onto the tracer.
3. When the pugmark is deep in sand, soil or mud, a middle path between the outer margin and the inner margin has to be drawn.



Sample FORM - D

PUGMARK TRACING

FORM 'D' **D**

(To be filled by Field Unit Leader)

Sheet No................

Name of the Beat Officer...
Beat.................. Section.................... Range...................... Division..................... Date...................
Location of pugmark: *dusty road / moist earth / sand / mud / PIP*

....
Name of the route/river bank...
Age of pugmark... (days)
Time of tracing....................................... Direction of walk................................ (according to route)

Measurement of stride during normal walk (hind pug to hind pug)
Left to left Right to right

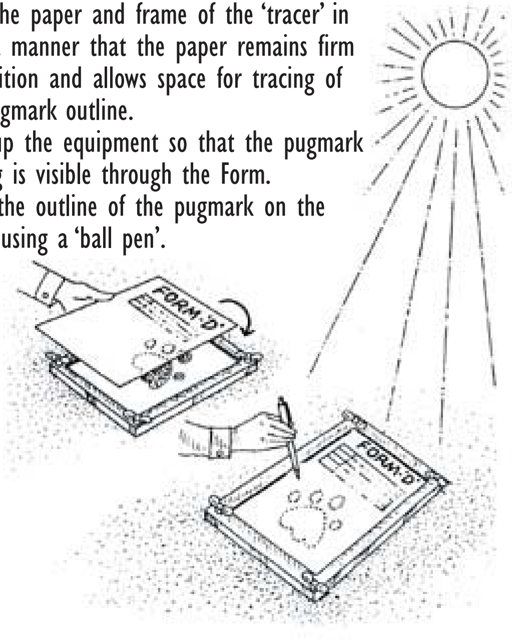
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Note: Space for pugmark tracing should be at least 17cm X 17cm. The form should be on thin or transparent paper.
Full Name of Tracer.. Signature of Tracer...

Signature/Address of non official Participant

To transfer pugmark tracing from the glass to FORM - D

1. Place the reverse side of Form-D on the glass with the pugmark tracing.
2. Sit down comfortably facing the sun.
3. Hold the paper and frame of the 'tracer' in such a manner that the paper remains firm in position and allows space for tracing of the pugmark outline.
4. Hold up the equipment so that the pugmark tracing is visible through the Form.
5. Trace the outline of the pugmark on the paper using a 'ball pen'.

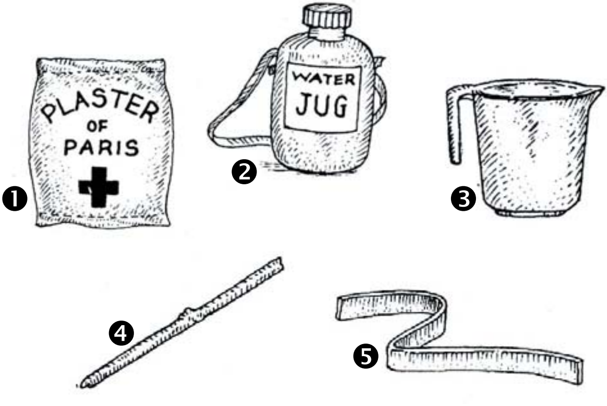




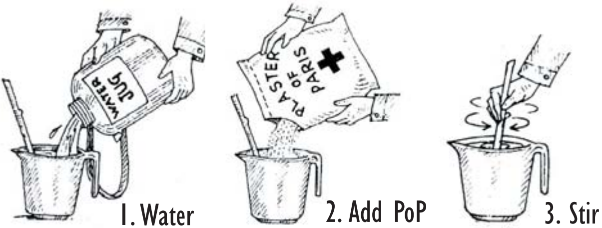
To make a plaster cast

We need:

1. Plaster of Paris (Medical quality)
2. Water
3. A mug to prepare paste
4. A strip of thick paper or flexible aluminium
5. A stick to stir

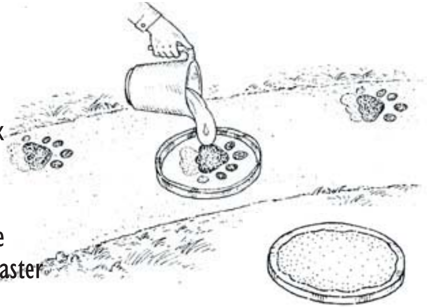


How to make a plaster cast



1. Water 2. Add PoP 3. Stir

4. Encircle the pugmark with aluminium strip/thick paper



5. Gently put mixture thinly dusted with plaster of paris

Aluminium strip

6. Allow plaster cast to dry and harden

A good plastercast can indicate field conditions as well as an individual's identity.

Information to be written on the back of the plaster cast

Before the plaster cast dries up completely, use a thin stick to write the following information that will be needed during analysis:

1. Unit name
2. Unit number
3. Date
4. Place
5. Reference number for tracing
6. Initials

Distinguishing pugmarks of tiger cubs from adult leopard

A three to four months old tiger cub will make pugmarks that can be confused with those made by a leopard because of similarity in size.

Look for the following:

1. The tracks of the mother tigress will invariably occur alongside those of her cub. Tiger cubs of that age do not move independently.
2. The pug impression of an adult leopard is compact. The pad and the toes are held closer together.
3. The pugmark made by a tiger cub is more splayed out. The pad and the toes are held more loosely.
4. When compared, a leopards toe prints are smaller and narrower than those of a tiger cub.
5. The stride of a tiger cub is about ten times its PML.
6. The stride of an adult leopard is about 13 - 14 times its PML.



Pugmark of a tiger cub



Pugmark of a leopard

Important to remember

1. Pugmarks with PML less than 6 cms are likely to belong to lesser cats.
2. PML of pugmarks falling between 5 - 7 cms could belong to leopard cubs.
3. PML of pugmarks falling between 7 - 9.5 cms may belong to adult leopards.
4. Pugmarks with PML falling between 7 - 10 cms could have been made by Tiger cubs.
5. PMLs from 9 - 17 cms indicate adult tigers.

Key factors

Success and results of tiger / leopard enumeration depends on the following factors:

1. Complete details in Form-D.
2. The accuracy of pugmark tracings.
3. The quality of pugmark plaster cast.

And above all, an honest approach!

Tiger and Wildlife Programme of WWF-India aims to strengthen the Protected Areas of India. Through its various field offices, it provides infrastructural support for better management and protection of the PAs.

It also works closely with the communities living around the tiger habitat to raise their awareness and to elicit their support for the conservation of wildlife.

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